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# CLIMATIC ABERRATIONS & THE FARMER : WEATHER EXTREMES AT BEAVERLODGE

CANADA AGRICULTURE RESEARCH BRANCH
RESEARCH STATION, BEAVERLODGE, ALTA

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# CLIMATIC ABERRATIONS AND THE FARMER: WEATHER EXTREMES AT BEAVERLODGE

A. C. Carder[1]
Research Station
Beaverlodge, Alberta

Since in a sense climate is "average weather" it follows that if we work out a good average we will obtain a reasonably true measure of climate. Although much used this procedure is hardly sufficient for a complete picture of the climate of a region. Weather extremes are important, too, and may in the end decide whether a plant can survive or a structure serve well. In this paper the occurrence of extremes during 50 years of weather recording at Beaverlodge, in the upper Peace River region of Western Canada, is discussed. The more general aspects of the climate of this agricultural area and the modifications this climate has undergone through the years have been described elsewhere (1,2).

The first settlers trekked into the region about 1910. Some took up land in the Beaverlodge area. Among these was an enterprising homesteader, W. D. Albright, founder of the Beaverlodge Research Station. On August 15,1915, Mr. Albright started taking daily weather records at a site which proved to be free from microclimatic influence that may have affected the records in later years. These records now represent the longest series of continuous weather data in the region.

Besides being a valuable asset to research work, the Beaverlodge weather records can substantiate or disprove many an old-timer's tale. Weather extremes are rather frequent because of the continental nature of the climate. Continental climates, untempered by the moderating effect of the ocean, are usually exceedingly variable. Occasionally, extreme conditions persist for weeks and even months. Indeed, it seems that the longer a certain pattern exists the more persistent it becomes. Thus, a whole summer may be unusually dry or wet or a whole winter cold and stormy.

For example, over the time that records have been kept at Beaverlodge there have been years when as little as 10 inches of precipitation fell and others when over 27 inches occurred, while a year with a "normal" amount is a rare event (Figure 1). Summer season (May to September) precipitation is also highly variable and is much more important for the growth of crops. As our summers are very variable, so are our winters. The vertical lines in Figure 2 show how far from normal each winter is. The sinuous trend line, calculated by smoothing technique, also shows that there is a tendency for cold and snowy, and mild and open winters to come in clusters. Less than half of the winters are of the "normal" type.

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[1] Agrometeorologist.

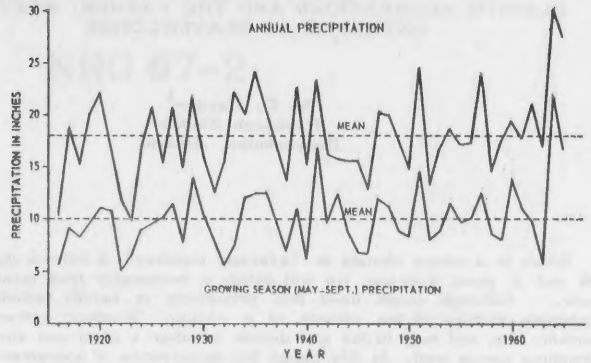


FIGURE 1 - Mean annual and growing season precipitation.

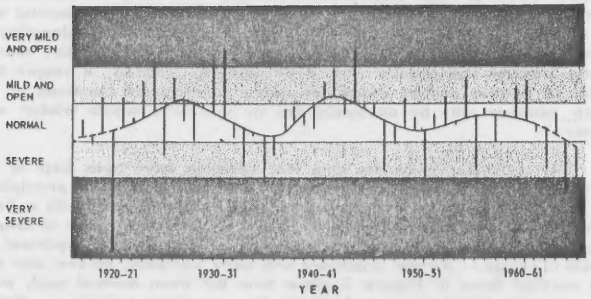


FIGURE 2 - Winter severity as measured by degree of cold and depth of snow.

First, let us talk about bad winters of the kind that we like to tell our children and the old-timers tell us. In country areas winters are remembered by their snow as well as their cold. The old-timers, at least, have a point for the records show that nothing like the winter of 1919-20 has ever recurred (Figure 2). Apparently the pattern was set late in October by a severe snow storm that stopped harvest. There was little respite from then until early May, and April arrived with nearly 4 feet of snow on the ground (Figure 3A).

It is not necessary to look far back for the second and third worst winters recorded. The second occurred in 1964-65, the third in 1965-66 (Figure 2). Both are poor competitors to the one of 45 years ago (Figure 3B). There were heavy snows in the winter of 1962-63, but warm spells were frequent so that there was no deep build-up of snow. Further, the snow fall that winter was 20 inches short of that of 1919-20. Other winters with deep snow and unusual cold, in order of severity, are: 1934-35, 1950-51, and 1946-47.

Unusually mild and open winters are remembered also. Pleasant memories remain of that of 1930-31 when for long periods the ground was bare of snow (Figure 3C).

In an average winter, temperatures reach their lowest late in January and snow depth its greatest one month later (Figure 3D). The heaviest snowfalls occur in January. The temperature curve indicates the frequent occurrence of a mild spell in early January, or the presence of a "January thaw".

In the Peace River area with its short growing season it is necessary to plant most field crops as early as possible. Very late springs cause concern. At Beaverlodge the first planting of wheat is about April 28, but there have been springs when this could not be done until May 18. One of these followed the great winter of 1919-20 which continued through the whole of April. Records show that enough snow remained into May to give good sleighing for the first 5 days of that month (Figure 4A). On May 4 the temperature exceeded 50°F for the first time since October 19. Snow did not leave the fields until early May. The snowiest and coldest April on record was that of 1948 (Figure 4B) but this followed a benign winter. Moreover, this April was little worse than that of 1920. Spring planting in 1948 commenced on May 15. The severe winter of 1964-65 persisted into late April (Figure 4C), but planting commenced on May 5. Normally, temperatures rise rapidly in April and there are only a few inches of winter's accumulation of snow left by early that month (Figure 4D).

In regions with a continental climate, extremes can be expected and, as shown in the comparison of winters, aberrations lasting several months may take place. Summer seasons vary also, but even the warmest summers have cool periods and the coolest warm periods (Figure 5). Much greater differences occur in the amount of rain. Such extremes can result in near disaster to crop production. Figure 6 shows the wettest and driest summers ever recorded. Very similar to the summer of 1922 was that of 1963, while that of 1964 was unprecedented for the series of heavy rains through June to August (note normal precipitation curve).

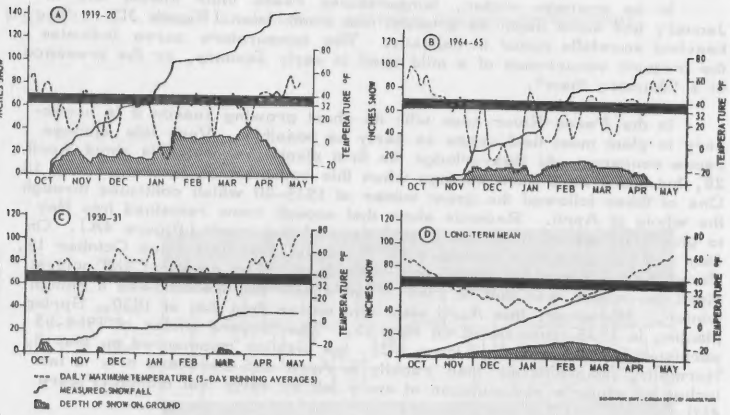


FIGURE 3 - Unusual winters and the normal, based on 50-year mean. Note that the snow cover settles but does not melt much unless the daily maximum temperature exceeds 40°F.

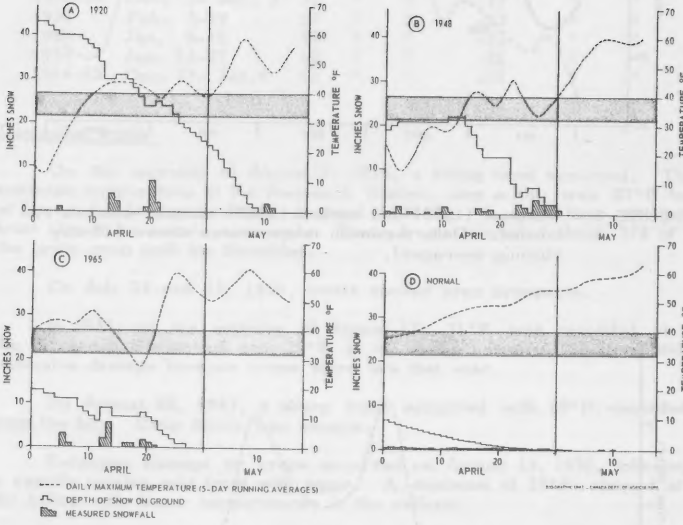


FIGURE 4 - Unusually late springs and the normal, based on 50-year mean.

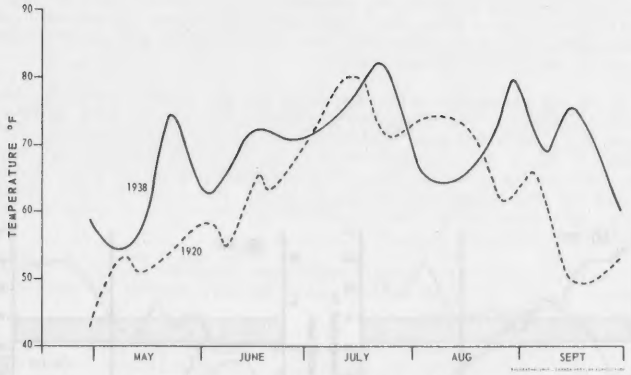


FIGURE 5 - Warmest (1938) and coolest (1920) summer seasons recorded. Daily maximum temperatures shown (10-day running averages).

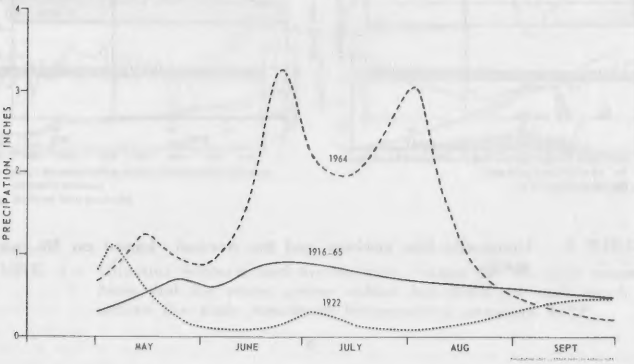


FIGURE 6 - Wettest (1964) and driest (1922) summer seasons and 50-year mean. Based on daily precipitation records (running averages).

## CALENDAR OF WEATHER EVENTS

A memorable weather event impresses itself on the mind. Many of the reasons are listed below and the associated event recorded chronologically.

### Extreme cold

Occasionally in the winter sub-zero cold sets in which persists for many days and creates hardship on animal and man. In 50 years' records there have been 14 times when the temperature remained below zero for more than 10 days. The worst of these spells occurred in:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1916 | Jan. 21-31 | 11 | days | duration | -28°F | mean temperature |
| 1933-34 | Dec. 2- Jan. 2 | 32 | " | " | -17 | " " |
| 1936 | Feb. 3-19 | 17 | " | " | -23 | " " |
| 1950 | Jan. 6-16 | 11 | " | " | -23 | " " |
| 1954 | Jan. 13-27 | 15 | " | " | -26 | " " |
| 1964-65 | Dec. 27- Jan.8 | 13 | " | " | -23 | " " |

### Damaging frosts

On the morning of August 9, 1916, a killing frost occurred. The minimum temperature at the Research Station, atop a hill, was 27°F but at lower levels temperatures dropped to 20°F. A week later another frost almost as severe occurred. These frosts rendered about 3/4 of the grain crop unfit for threshing.

On July 22 and 23, 1918, frosts spoiled crop prospects.

In 1935, on the morning of August 17, 31°F was recorded at the Research Station hill and 25°F in the valley below. This frost did extensive damage because crops were late that year.

On August 20, 1947, a sharp frost occurred with 28°F recorded atop the hill. Crop injury was severe.

Extensive damage to crops occurred on August 15, 1950, following a rapidly moving cold front with snow. A minimum of 27°F showed at the hilltop with lower temperatures in the valleys.

These are the severe frosts, others occurred. Damaging frosts happen less frequently now than they did in pioneer times due to the lengthening of the growing season associated with the general warming of the northern hemisphere. The availability of earlier maturing crops in recent years has also reduced the chances of frozen grain.

### Hail storms

Destructive hail storms are rare in the Peace River region. Damaging hail has never fallen at the Research Station but on two occasions came close.

On July 26, 1951, one of the most savage hail storms in the memory of settlers occurred to the southwest of Beaverlodge. Crops were churned into the ground and bark was peeled from large trees whose scrags still stand.

Accompanying intense rain, hail destroyed crops to the immediate north of Beaverlodge on August 22, 1965.

Dust storms

Because of improved farm methods severe dust storms have not occurred for many years. They were first mentioned in the records in 1919 when in the spring of that year noticeable soil drifting took place. Their heyday was in the 1930's.

Limited soil drifting occurred in the springs of 1926, '28 and '29 and soil blowing went on even through the winter of 1930-31. There was more drifting in the spring of 1937, but the first real dust storms occurred on May 12-14, 1938, when soil banks several feet deep and 10 to 15 rods long were piled up. Such storms were repeated on a reduced scale in the spring of 1939, and in the autumns of 1945 and '47. This last occurred on October 12 when hundreds of acres of winter crops were destroyed and towns neighboring Beaverlodge were blacked out.

Snow storms and blizzards

Several great snow storms are recorded, but very few all-out blizzards.

Harvest activities were brought to a standstill on September 12, 1936, when snow amounting to 20 inches was piled from 6 to 8 feet deep by driving winds on that day and the next. Following this storm temperatures sank to zero in valley areas.

Between October 2 and 6, 1957, the greatest snow storm ever to visit the district since the arrival of settlers occurred. In this storm snow built up on the level to a depth of 32 inches with 42 inches of fallen snow being recorded. There was some drifting due to persistent though moderate, north and northwest winds. On the fourth day of the storm road traffic was stopped. Following the storm temperatures dropped to zero.

Squall blizzards from the northwest are common and every bad winter has several. They accompany the arrival of cold fronts and are seldom dangerous because of rapid clearing. They last but a few hours at the most. There are times, too, when bitter, snow-carrying winds silt and drift snow for days at a time, but visibility is never rendered utterly nil. These conditions may occur repeatedly in bad winters.

A sustained, blinding blizzard with sub-zero temperatures is a different thing. Only a few are on record. Perhaps the worst was that of March 15, 1951. This started before daybreak and by evening was driven to a climax by northeast and north winds. This storm did not come suddenly; if it had loss of life would have been inevitable. Long before, Mr. Albright noted that on January 23, 1916, there was "northwest

gale with snow" and temperatures ranged from "-34 to-38°F". Semi-blizzard conditions existed throughout the day of March 28, 1920, and a full blizzard raged on December 11, 1926, but temperatures were only slightly below zero in this storm. There have been other occurrences of this kind but of less intensity. December and March seem to be bad months for such storms.

## Storms and floods

Very occasionally the stage is set for a deluge of rain, snow or a mixture of both. In the sub-humid Peace River region it is unusual to receive over 4 inches of moisture in a single storm. Yet at Beaverlodge this has happened six times in 50 years, viz:

| | | | |
|---|---|---|---|
| 1917 | May | 15-17 | 5.88 inches in the form of rain |
| 1929 | Sept. | 20-24 | 4.02 rain and snow |
| 1951 | July | 2-5 | 4.57 rain |
| 1957 | Oct. | 1-6 | 4.15 snow |
| 1964 | June | 27-28 | 4.32 rain |
| 1965 | June | 23-27 | 5.00 rain. |

In the 1951 storm 4 inches of rain fell in a single day, but for sheer intensity the rain of August 22, 1965, surpasses all. At the height of this storm during which 2.71 inches of rain were received, 0.56 inches fell in 5 minutes and 1 inch in 10 minutes. Most of the storm, or 2.34 inches of rain, had fallen within an hour.

Because of the undulating topography of the area, flooding is never extensive. Some great storms like that of 1951 did not cause flooding because of very dry conditions preceding. Others, like the storms of 1964 and '65, which occurred when the ground was saturated with moisture, did cause flooding in low lying fields and crops suffered considerably. The only other time when flooding became a problem was during the very wet summer of 1935.

## Poor harvest weather

Long remembered are autumns of poor harvest. At Beaverlodge it is rare that measurable amounts of precipitation fall on 10 consecutive days. In the unprecedented wet summers of 1964 and 1965, with their accompanying poor harvest conditions, no wet spell lasted longer than 6 days, although on some of these days the rainfall was extremely heavy. In late August, 1941, the most persistent wet spell ever to occur set in. There was measurable precipitation every day except 3 in the month of September. In one period, rain was recorded every day for 12 days. Grain in the sheaf sprouted and stooked sheaves formed green mounds in flooded fields. Indeed, there were instances of standing grain sprouting.

## Drought

At Beaverlodge no drought has been severe enough to cause crop failure, although this has happened in some localities within the Peace River region. The droughtiest summer on record was that of 1922, with 1963 almost as dry. Severe drought conditions prevailed also in 1917, 1924, 1938 and 1945.

In pioneer times drought was often accompanied by insect invasion such as grasshoppers and cutworms which intensified crop damage. These incursions have been reduced greatly in recent years by improved farming practices and by cultivation of the native grass lands, apparently a choice breeding habitat for injurious insects.

## Errant snow storms

June and August snow storms are rare events. June snow storms are usually a blessing as they provide much needed moisture, but snows in August are dreaded because of crop lodging and chance of accompanying frost.

The last June snow storm on record occurred in 1935, but before that one there were three. All such storms amounted to but a few inches of wet snow, with the exception of that of June 8-9, 1926, when 23 inches fell. One of the best crops in the country's history was harvested that year.

Two mid-August snow storms have occurred with a couple at a later date. On August 14, 1935, 3 inches of wet snow fell, followed by a general frost. The performance was repeated more drastically on August 14-15, 1950, when 4.5 inches of snow fell accompanied by wind and killing frost. Crop lodging was severe in these instances.

The latest record of snow was on June 11, 1920, when 4 inches of wet snow fell, while the earliest was on August 9, 1916, when enough to whiten the ground occurred.

## Errant cold spells

Undug potatoes and root crops are usually safe until the end of September, but there have been times when these were jeopardized. Danger comes when temperatures drop below 20°F and persist for several days and are accompanied by much wind and little snow. The first recorded instance of this kind occurred in late September, 1926. Deep snow saved root crops from the mid-September winter onslaught of 1936. The most severe instance occurred on September 26-27, 1951, when temperatures dropped to 16°F for two consecutive nights and the cold was accompanied by a driving wind and little snow. A considerable portion of the undug potato crop was frozen. September cold spells of a kind which do extensive damage to root crops are rare, apparently occurring only once or twice in half a century.

Heat waves and unusual winter thaws

Heat that causes extreme discomfort to man and animals or damage to crops is most unusual. The highest temperature recorded at Beaverlodge occurred during the heat wave of 1941 when on July 17 the temperature rose to 98.1°F. It was estimated to be hotter in valley areas where unofficial temperatures of up to 104°F were reported. Early grain crops were injured as they ripened prematurely without plump filling. Temperatures above 92°F were recorded on 4 consecutive days atop the hill. This is abnormal for such temperatures have been recorded only on 3 other isolated days at Beaverlodge.

Phenomenal mid-winter warm periods have occurred. There were two such in the very mild and open winter of 1930-31 (Figure 3C). The first took place in mid December when for 7 consecutive days the temperature rose above 60°F. On 2 of these days it was 62°F, or 48 degrees above normal. This performance was repeated in mid January when for 4 consecutive days temperatures above 60°F occurred, with one day having a maximum of 62°F, or 52 degrees above normal. The only other record of a mid-winter (December - February) temperature exceeding 60°F was on February 6, 1954, when 61°F was recorded during an exceptionally warm period. Mid-winter warmth is invariably associated with strong chinook conditions.

Sudden temperature changes

As is common to continental climates, temperatures can rise and fall rapidly. Sudden rises are associated with chinooks and sudden drops with on-rushing cold fronts. Drastic temperature drops may cause extensive injury to over-wintering crops, particularly if they are not properly hardened-in. Given these conditions, and should the freezing-point be passed during the temperature drop severe killing can be expected. One of the worst occurrences of this kind happened on the night and early morning of November 10, 1955, when the temperature fell 18 degrees in one hour (Figure 7). The cold was accompanied by strong winds and practically no snow. Heavy loss of winter cereals, legumes and even grass crops prevailed the subsequent spring.

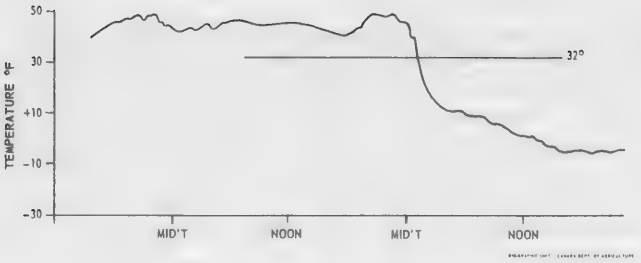


FIGURE 7 - Thermograph trace showing sudden drop in temperature from much above freezing to below zero, November 10-11, 1955.

Late and early "Freezing Days"

Of interest to a student of climate are the earliest and latest times of the year when temperature remains below freezing all day. The most extreme of these occurrences at Beaverlodge are listed in chronological order below, along with the maximum temperature for the day:

| | | |
|---|---|---|
| Sept. | 14, 1936 | 30°F |
| " | 14, 1965 | 31° |
| May | 3, 1919 | 28° |
| " | 2, 1959 | 26° |
| " | 3, 1959 | 30° |
| " | 2, 1961 | 30° |

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